GUIDE FOR TECHNICAL REVIEWS AND AUDITS

Technical Integration Division (TRT)

March 1971

TECHNICAL REQUIREMENTS AND STANDARDS OFFICE
HQ ELECTRONIC SYSTEMS DIVISION (AFSC)
L. G. Hanscom Field, Bedford, Massachusetts 01730

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FOREWORD

The proliferation of the many areas of specialization necessitates an integrated approach for the review and audit of complex technical efforts. This Technical Report integrates the requirements of the Electronic Systems Division (ESD) for the conduct of formal technical reviews/audits (jointly by the Procuring Activity and the contractor) on ESD programs/projects and identifies contractor and Procuring Agency tasks and responsibilities. Because the technical reviews/audits requirements contained herein have general applicability, on a "tailored" basis, to a wide range of system/equipment programs, this document has been termed a "guide."

This document updates ESD Exhibit EST-3 (Instructions for Conducting Formal Technical Reviews, Inspections, and Demonstrations) to reflect the known "Packard Policy" (28 May 1970 Memo), MIL-STD-499 (System Engineering Management), and MIL-STD-483 (Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs).

The requirements contained herein are directly applicable to ESD System Program/Project procurements managed in accordance with the Air Force (AF) and AF Systems Command (AFSC) 375-series regulations/manuals, and Less-Than-Systems (LTS) "tailoring" of the above policies.

The application of the technical reviews/audits to the new life-cycle phases (i.e., conceptual, validation, full-scale development, and production) cannot be predetermined and in the final analysis relies on the creativity and judgment of the System Program Director/Project Manager. A flow chart (see Figure 1) has been provided, however, to indicate the time phasing of the major program activities. Since various combinations of activities are applicable, in varying degrees, to each life-cycle phase, the selection of the reviews/audits for each phase, and which items will require considerable deliberation. The use of varied, i.e., preliminary, delta, collective, and incremental approaches for the conduct of reviews/audits must also be considered to optimize the review/audit requirements to the overall phasing of the program/project.

Within ESD, the Technical Integration Division (TRT) of the Technical Requirements and Standards Office (TR) is the ESD staff office of prime responsibility for technical reviews and audits. TRT is indebted to: 1) its fellow TR divisions (Systems Logistics Division, Technical Data Division, Value Engineering Division, and Scientific and Technical Information Division); 2) the Staff Meteorological Office; 3) the staff offices for safety, electromagnetic compatibility, and survivability/vulnerability, and; 4) the many SPOs and project offices which have contributed to this document.

This Technical Report has been reviewed and is approved.

Carmine Pinto

CARMINE PINTO, Chief
Tech Rqmts & Stds Office

ABSTRACT

Provided are joint Procuring Agency-Contractor requirements for the actual conduct of the following technical reviews and audits:

System Requirements Review (SRR)
System Design Review (SDR)
Preliminary Design Review (PDR)
Critical Design Review (CDR)
Functional Configuration Audit (FCA)
Physical Configuration Audit (PCA)
Formal Qualification Review (FQR)

The requirements contained herein are in consonance with the "Packard Policy" (28 May 1970 Memo), MIL-STD-499 (System Engineering Management), and MIL-STD-483 (Configuration Management Practices for Systems, Equipments, Munitions, and Computer Programs). This document supersedes ESD Exhibit EST-3 (Instructions for Conducting Formal Technical Reviews, Inspections, and Demonstrations).

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CHAPTER 1

GENERAL REQUIREMENTS AND PROCEDURES

1.1 Introduction. This document provides the necessary requirements and guidance, in sufficient depth, for the conduct of the following Technical Reviews and Audits:

System Requirements Reviews (SRRs)
System Design Review (SDR)
Preliminary Design Review (PDR)
Critical Design Review (CDR)
Functional Configuration Audit (FCA)
Physical Configuration Audit (PCA)
Formal Qualification Review (FQR)

The relative time-phasing of the Reviews and Audits is shown in Figure 1.

The Technical Review requirements contained herein are in consonance with the criteria contained in MIL-STD-499. The Technical Reviews are followed by the Configuration Management Audits/Reviews which are in accordance with MIL-STD-483 and AFSCM 375-7.

The Reviews assist the System Program Office (hereafter referred to as the Procuring Agency), Support, Training, and Using Command personnel in assuring that the system design is maturing in a logical manner during the Definition and/or Development/Production processes for system hardware, computer programs, facilities, personnel, and integrated logistics support elements.

This document provides planning and preparation instructions for both the contractor and the Procuring Agency for conducting each Review/Audit. Specific criteria to be evaluated by participants at a Review are also provided.

1.2 Requirements. The Procuring Agency is responsible for determining the requirements for the Reviews/Audits and the incorporation of these requirements into the statement of work. The contractor is responsible for the conduct of the Technical Reviews and Audits to the extent specified in the contract.

1.2.1 Subcontractors and Suppliers. The contractor is responsible for insuring that his subcontractors, vendors, and suppliers participate in formal Reviews/Audits, as appropriate.

1.2.2 Location. Unless otherwise specified in the Statement of Work, the Reviews/Audits are conducted at the contractor's facility. Accordingly, the contractor is required to provide the necessary resources and material to effectively perform the Review/Audit. This includes the following items to the extent appropriate for the type and scope of Review/Audit and as required by specific contract:

a. Meeting agenda/plans.
b. Conference room(s).
c. Applicable system engineering data, specifications, drawings, manuals, schedules, and design and test data.
d. Specialty study results.
e. Trade study results.
f. Risk analysis results.
g. Mockups, breadboards, in-process hardware, and finished hardware.
h. Test methods and data.
i. Meeting minutes.

1.3 Procedures:

1.3.1 Contractor Preparation and Participation. The contractor is responsible for establishing the time, place, and agenda for each Review/Audit in consonance with master milestone schedule, subject to coordination with the Procuring Agency. This must be accomplished sufficiently in advance of each Review/Audit to allow adequate preparation for the meeting by both the contractor and the Procuring Agency. In addition, the contractor:

a. Insures that each Review/Audit schedule is compatible with the availability of the necessary information and contract articles, e.g., system engineering data, trade study results, risk analysis results, specifications, manuals, drawings, reports, hardware, or mock-ups.

b. Prepares for each Review/Audit in sufficient detail consistent with the scope and magnitude of the Review/Audit.

c. Designates a co-chairman for each Review/Audit. This individual provides the contractor's position for official minutes. Participating contractor and subcontractor personnel or those chosen to make presentations should be prepared to discuss in technical detail any of the presented material within the scope of the Review.

d. Provides a stenographer to record inputs to official meeting minutes. Minutes are recorded only as dictated by either co-chairman and mainly consist of significant questions and answers, action items, deviations, conclusions, recommended courses of action resulting from presentations or discussion. Conclusions from discussions conducted during side meetings are summarized in the main meeting at an appointed time, and appropriate comments are read into the official minutes.

e. Clearly records all action items in the minutes and identifies whether Procuring Agency and/or contractor's action is required for its resolution. An example action item form is provided as Figure 2 as guidance.

f. Publishes and distributes official minutes in accordance with the data item requirement on the Contract Data Requirements List(CDRL).

1.3.2 Procuring Agency Participation and Responsibilities. The Procuring Agency participates in each Review/Audit to the extent specified below:

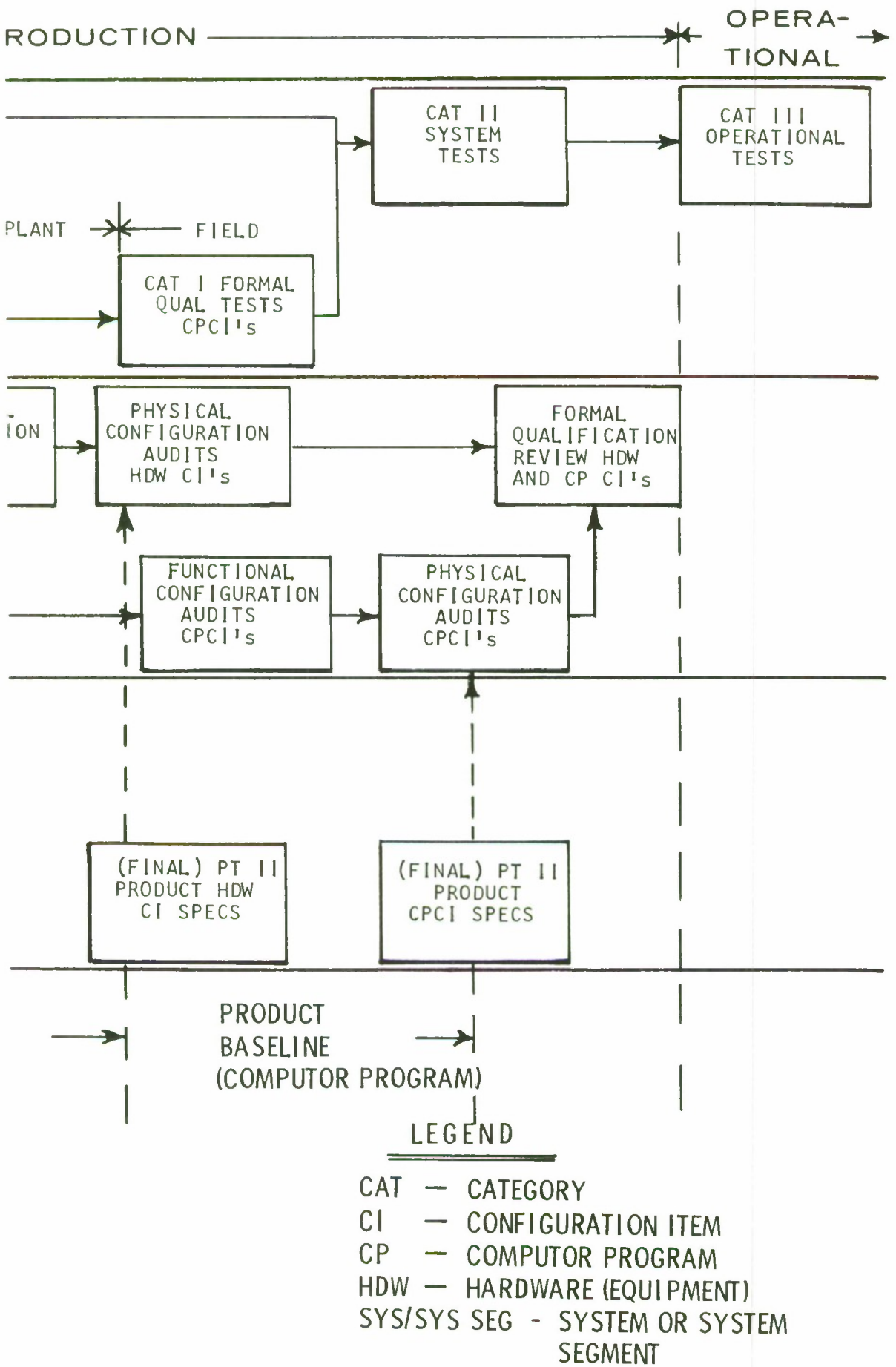
a. Serves as co-chairman.

b. Invites personnel from affected organizations, e.g., 1) local staff (e.g., staff specialists); 2) command staff; 3) other commands (e.g., Using, Logistics, and Training Commands); 4) other Government agencies; and, 5) General System Engineering/Technical Direction contractor and/or Integration contractor, to ensure integrated coverage of the evolving system definition, design, development, test, and personnel/training requirements. Attendance is limited to those who are knowledgeable and can significantly contribute to a particular Review/Audit. Final selection of individuals is the prerogative of the Procuring Agency.

c. Provides the name, organization, and security clearance of each participating individual to the contractor five working days prior to each Review/Audit.

d. Provides formal acknowledgment to the contractor of the accomplishment of each Review/Audit within ten working days after receipt of Review/Audit minutes and notifies him of requirements for post-Review/Audit actions.

NOTE: Official acknowledgment by the Procuring Agency of the accomplishment of a Review/Audit is not to be interpreted as approval of statements made in the minutes or of matters discussed at the Review-Audit and does not relieve the contractor from requirements which are a part of the contract.


RODUCTION
OPERA-
TIONAL
CAT II
SYSTEM
TESTS
CAT III
OPERATIONAL
TESTS
PLANT
FIELD
CAT I FORMAL
QUAL TESTS
CPCI's
ION
PHYSICAL
CONFIGURATION
AUDITS
HDW CI's
FORMAL
QUALIFICATION
REVIEW HDW
AND CP CI's
FUNCTIONAL
CONFIGURATION
AUDITS
CPCI's
PHYSICAL
CONFIGURATION
AUDITS
CPCI's
(FINAL) PT II
PRODUCT HDW
CI SPECS
(FINAL) PT II
PRODUCT
CPCI SPECS
PRODUCT
BASELINE
(COMPUTOR PROGRAM)
LEGEND
CAT — CATEGORY
CI — CONFIGURATION ITEM
CP — COMPUTOR PROGRAM
HDW — HARDWARE (EQUIPMENT)
SYS/SYS SEG - SYSTEM OR SYSTEM
SEGMENT

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ACTION ITEM

CONTROL NO. _____

DATE OF MEETING	SUBJECT:	LOCATION

ACTION REQUIRED/COMPLIANCE DUE DATE: _____

ASSIGNED TO: _____ ORIGINATOR

AGENCY

FOLLOW UP
STATUS: _____

ASSIGNEE:

DATE COMPLETED: DOCUMENT NO.

COORDINATORS TECHNICAL APPROVAL

	PHONE	AGENCY	SIGNATURE	DATE
	PHONE	AGENCY	SIGNATURE	DATE
	PHONE	AGENCY	SIGNATURE	DATE

AIR FORCE	DATE	CONTRACTOR	DATE	CONTRACTS	DATE

Figure 2. Example Action Item Form

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CHAPTER 2

SYSTEM REQUIREMENTS REVIEW (SRR)

2.1 General. The SRRs are in-process reviews conducted during the system validation or full-scale development effort. The number of such reviews is determined by the Procuring Agency.

Such a review may be conducted after the accomplishment of functional analysis and preliminary requirements allocation (to operational/maintenance/training hardware CIs, computer program CIs, facility CIs, personnel, and procedural data) to determine initial direction and progress of the contractor's System Engineering Management effort and his convergence upon an optimum and complete configuration.

2.2 Purpose. The total System Engineering Management activity and its output are reviewed for responsiveness to the statement of work and System or System Segment Specification requirements. Procuring Agency direction to the contractor will be provided, as necessary, for continuing technical program and system optimization.

2.3 Requirements. Representative items to be reviewed include the in-process results of the following (as appropriate):

a. Mission and Requirements Analysis.
b. Functional Flow Analysis.
c. Preliminary Requirements Allocation.
d. System/Cost Effectiveness Analysis.
e. Trade Studies.
f. Synthesis.
g. Integrated Logistics Support Analysis.
h. Specialty Discipline Studies.
i. System Interface Studies.
j. Generation of Specifications.
k. Program Risk Analysis.
l. Integrated Test Planning.
m. Producibility Analysis.
n. Technical Performance Measurement Planning.
o. Engineering Integration.
p. Data Management.
q. Configuration Management.

The contractor shall describe his progress and problems in: 1) risk identification and risk ranking (the inter-relationships with system/cost effectiveness analysis and technical performance measurement shall be discussed, as appropriate); 2) risk avoidance/reduction and control (the inter-relationships with trade-off studies, test planning, hardware proofing, and technical performance measurement shall be discussed, as appropriate); 3) significant trade-offs between stated system or system segment specification requirements/constraints and resulting engineering design requirements/constraints; and, 4) significant

producibility considerations which are visible this early in the program (e.g., critical materials, tooling, processes, and facilities).

Information which the contractor identifies as being useful to his analysis and available through the Procuring Agency shall be requested at this review (e.g., prior studies, operational/support factors, cost factors, safety data, test plan(s), etc.) A separate SRR may be conducted for each of the operational and support subsystems depending upon the nature and complexity of the program.

2.4 Post Review Action. Within five working days after completing the SRR, the contractor publishes and distributes copies of Review minutes as specified by the CDRL. The Procuring Agency officially acknowledges completion of the SRR as indicated in Chapter 1, para 1.3.2.d.

CHAPTER 3

SYSTEM DESIGN REVIEW (SDR)

3.1 General. The SDR is conducted to evaluate the optimization, traceability, correlation, completeness, and the risk of the allocated requirements, (allocated configuration identification) including the corresponding test requirements in fulfilling the System or System Segment requirements (the functional configuration baseline). The review encompasses the total system requirements, i.e., operations/maintenance/test/training hardware, computer programs, facilities, personnel, and procedural data. Also, included is a summary review of the System Engineering Management activities (e.g., mission and requirements analysis, functional analysis, requirements allocation, program risk analysis, system/cost effectiveness analysis, integrated logistics support analysis, trade studies, intra- and inter- system interface studies, integrated test planning, specialty discipline studies, and Configuration Management) which produced the above system definition products.

A technical understanding is reached on the validity and completeness of the following specifications (as appropriate):

a. System Specification.
b. System Segment Specification.
c. Part I CI Development Specifications.
d. Critical Item Specification(s), and the engineering/cost realism of the above synthesis.

3.2 Purpose. A SDR is conducted as the final review prior to the submittal of the Validation Phase products or as the initial Full-Scale Development Review for systems not requiring a formal Validation Phase but sufficiently complex to warrant the formal assessment of the allocated requirements (and the basis of these requirements) before proceeding with the preliminary design of CIs. The SDR is primarily concerned with the overall review of the operational/support requirements (i.e., the mission requirements), updated/completed system specification requirements, allocated performance requirements, and the accomplishment of the System Engineering Management activities to insure that the definition effort products are "necessary and sufficient." The purposes of the SDR are to:

a. Insure that the updated/completed system specification is adequate and cost effective in satisfying validated mission requirements.

b. Insure that the allocated requirements represent a complete and optimal synthesis of the system requirements.

c. Insure that the technical program risks are identified, ranked, avoided, and reduced through: 1) adequate trade-offs (particularly for

sensitive mission requirements versus engineering realism of corresponding performance requirements); 2) subsystem/component hardware proofing, and; 3) a responsive test program.

d. Identify how the final combinations of operations, maintenance, and test and activation requirements have affected overall program concepts; quantities and types of equipment, computer programs, personnel, and facilities; evaluate use of available Government assets including Federal Stock Numbered (FSN) configuration items, and available commercial "off-the-shelf" equipments/computer programs.

e. Insure that a technical understanding of requirements has been reached and technical direction is provided to the contractor.

3.3 Requirements. The SDR includes a summary review of the following items, as appropriate:

a. System Engineering Management activities, e.g.:

(1) Mission and Requirements Analysis.
(2) Functional Analysis.
(3) Requirements Allocation.
(4) System/Cost Effectiveness.
(5) Synthesis.
(6) Survivability/Vulnerability.
(7) Reliability/Maintainability.
(8) Electromagnetic Compatibility.
(9) Integrated Logistics Support.
(10) Safety (emphasis shall be placed on system hazard analysis and identification of safety test requirements).
(11) Security.
(12) Personnel Subsystem/Human Factors.
(13) Transportability.
(14) System Mass Properties.
(15) Standardization.
(16) Electronic Warfare.
(17) Value Engineering.
(18) System Growth Capability.
(19) Program Risk Analysis.
(20) Technical Performance Measurement Planning.
(21) Producibility Analysis (i.e., significant aspects of materials, tooling, processes, facilities, skills, etc.)

b. Results of significant trade studies, e.g.:

(1) Sensitivity of selected mission requirements versus realistic performance parameters.
(2) Operations design versus maintenance design.
(3) System centralization versus decentralization.
(4) Automated versus manual operation.
(5) Redundance versus non-redundancy.

(6) "Off-the-shelf" items versus new developments.
(7) Standard common (FSN) items versus new development.
(8) Built-in-test-equipment (BITE) versus separate AGE.
(9) Size and weight for transportability versus size and weight for electromagnetic compatibility.
(10) Desired propagation characteristics versus reduction in interference to other systems (optimum selection of frequencies).

c. Updated design requirements for operations/maintenance functions.

d. Updated design requirements for operations/maintenance items.

e. Updated operations/maintenance requirements for facilities.

f. Updated requirements for operations/maintenance personnel and training.

g. Specific actions to be performed include evaluations of:

(1) System design feasibility and system/cost effectiveness.
(2) Capability of the selected configuration to meet requirements of the System/or System Segment Specification.
(3) Allocations of system requirements to subsystems/CIs.
(4) Verification that "off-the-shelf" and FSN items have been used to the maximum practicable extent.
(5) Allocated inter-and intra- system interface requirements.
(6) Allocations of size and weight to CIs to permit transporting and transportability per applicable specifications.
(7) Specific design concepts which may require development toward advancing the state-of-the-art.
(8) Specific subsystems/components which may require "hardware proofing" and high-risk long-lead time items.
(9) The ability of requirement items to meet overall system requirements, and compatibility between requirement item and CI interfaces.
(10) The planned system design in view of providing multimode functions, as applicable.
(11) Redundant system elements in terms of reliability.
(12) Considerations given to:

(a) interference caused by the external environment to the system and the system to the external environment,

(b) allocated performance characteristics of all system transmitters and receivers to identify potential intra-system EM incompatibilities,

(c) nondesign, spurious and harmonic system performance characteristics and their effect on electromagnetic environments of operational deployments.

(13) During the SDR sections 1.0, 2.0, 3.0, 5.0, 6.0 and 10.0 of the system/system segment CI/critical item specifications are reviewed for format, content, technical adequacy, completeness and traceability/correlation to the validated mission/support requirements. All entries marked "not applicable (N/A)" or "to be determined (TBD)" are identified and explained by the contractor.

h. During the SDR, Section 4.0 of the System Specification and all Part I Development Specifications are reviewed for format, content, technical adequacy, and completeness. All available test documentation, including Category I and II Test Plans, is reviewed to insure that the proposed test program satisfies the test requirements of Section 4.0 of the System and Part I CI Development Specifications. All entries labeled "not applicable (N/A)" or "to be determined (TBD)" in Section 4.0 of the System Specification and Part I CI Development Specification are identified and explained by the contractor.

i. Natural environmental (climatic) service conditions are reviewed for possible effect on the system and its effectiveness. The system design is reviewed for interaction with the natural environment. If any effect or interaction is not completely understood and further study is required, or it is known but not completely compensated for in the design, the proposed method of resolution must also be reviewed.

j. A review must also be performed to insure compatibility between the CI and the source, parameter formats, display requirements, etc., for any natural environmental information required. All proposed environmental tests are reviewed for compatibility with the specified natural environmental (climatic) conditions.

k. Maintenance functions developed by the contractor are reviewed to determine that support concepts are valid, technically feasible, and understood. In particular, Reliability and Maintainability (R&M) attention is given to:

(1) R&M considerations in the updated System or System Segment Specification.

(2) Maintenance design characteristics of the system.

(3) Corrective and preventive maintenance requirements.

(4) Special equipment, tools, or material required.

(5) Requirements or planning for automated maintenance analysis.

(6) Item Maintenance Analysis Compatibility with AFM 66-1 program.

(7) Specific CI maintenance design requirements.

(8) Forms, procedures, and techniques for maintenance analysis.

(9) Maintenance-related trade-off studies and findings.

l. System compliance with nuclear hardening requirements. High risk areas or design concepts requiring possible advances of the state-of-the-art as a result of survivability criteria shall be identified and

prepared approach(es) to the problem reviewed. Prepared radiation test programs shall be reviewed for sufficiency and compatibility with the specified threat environment and existing simulation test facilities.

m. Results of the computer programming requirements to include:

(1) The computer programming techniques to be adopted for use in the system, e.g., on-line processing, off-line processing, parallel or multi-processing, multi-programming, time sharing, etc.

(2) A gross description of the size and operating characteristics of all computer programs (e.g., operational programs, maintenance/diagnostic programs, compilers, etc.) to include data base and compool requirements.

(3) A description of requirements for system exercising and identification of functional requirements (exercise configuration, conditions, missions, frequencies, functional simulation, recording, and analysis), and identification of major elements required to implement the exercising capability.

(4) Identification of all computer programs required throughout the system. Examples are: operational programs; maintenance/diagnostic programs; test/debug programs; exercise and analysis programs; simulation programs; and compilers, assemblers and other required support programs.

(5) Identification of all computer programming languages to be utilized in the system, and a description of how each language impacts the operations, maintenance, and test areas.

3.4 Post Review Action. Within five working days after completing the SDR, the contractor publishes and distributes copies of Review minutes as specified by the CDRL. The SPO officially acknowledges completion of the SDR as indicated in Chapter 1, paragraph 1.3.2.d.

CHAPTER 4

THE PRELIMINARY DESIGN REVIEW (PDR)

4.1 General. The PDR is a formal technical review of the basic design approach for functionally related groups of configuration items (CIs). It is held after Procuring Agency approval of the Part I Development specification(s) and the accomplishment of preliminary design efforts, but prior to start of the detail design. Only one successful PDR is required for each CI. A collective PDR for a group of CIs, treating each CI individually, may be held when such an approach is advantageous to the Procuring Agency. The overall technical program risks, associated with each CI, shall also be reviewed on a technical, cost, and schedule basis.

4.1.1 Items to be Reviewed. The contractor, as a minimum, reviews the following:

a. Equipment CIs, General:

(1) Preliminary design synthesis of the approved Part I CI Development Specification for the item being reviewed.

(2) Trade-offs and design studies results (see para's 3.3.a(1) and 3.3.a(2) of SDR for a representative listing).

(3) Functional flows, requirements allocation data, and schematic diagrams.

(4) Equipment layout drawings.

(5) Environment control and thermal design aspects.

(6) Electromagnetic compatibility of the preliminary design.

(7) Power distribution and grounding design aspects.

(8) Preliminary mechanical and packaging design of consoles, racks, drawers, printed circuit boards, connectors, etc.

(9) Safety engineering considerations.

(10) Security engineering considerations.

(11) Survivability/Vulnerability considerations.

(12) Preliminary lists of materials, parts, and processes.

(13) Pertinent reliability and maintainability data.

(14) Preliminary weight data.

(15) Development test data.

(16) Interface data.

(17) CE Development schedule.

(18) Mock-ups, models, breadboards, or prototype hardware when appropriate.

(19) Producibility of the preliminary design (i.e., significant materials, tooling, processes, facilities, skills, instrumentations, etc., considerations).

(20) Value Engineering considerations and preliminary VECPs under consideration.

b. Computer Program CIs (CPCIs):

(1) Computer Program Functional Flow. This information should be completed to the level of flow charting which identifies the allocation of computer program components to functions and depicts the sequence of operation within the system functional flow.

(2) Storage Allocation Charts. This information should be detailed for the CPCI as a whole, describing the manner in which available storage is allocated to individual computer programs. Timing, sequencing requirements, and relevant equipment constraints used in determining the allocation are to be included.

(3) Control Functions Description. A description of the executive control and start/recovery features for the computer program system should be available, including method of initiating system operation and features enabling recovery from system malfunction.

(4) Structure and Organization of the Data Base. The data base description should be completed to a level which identifies data types and characteristics, structure layout, and allocation of data storage.

c. Aerospace Ground Equipment (AGE):

(1) Review considerations applicable to hardware and computer program CIs (para 4.1.1a. and 4.1.1b.), as appropriate.

(2) Verify optimal trade-off of BITE versus separate AGE.

(3) Verify maximum use of GFE AGE.

(4) Review progress of long-lead time AGE items.

(5) Review progress toward determining total AGE requirements for installation, checkout, and test support requirements.

(6) Review requirement for System/CI Printed Circuit Board (PCB) Tester.

(7) Review expected number and type of PCBs CI contributes to system.

(8) Review expected number of PCBs that tester will test.

(9) Summarize progress and plans for tester.

4.2 Evaluation of Electrical, Mechanical, and Logical Designs:

a. Equipment Configuration Items. The material of paragraph 4.1.1a above is evaluated to:

(1) Determine that the preliminary detail design provides the capability of satisfying the performance characteristics paragraph of the Part I CI Development specification.

(2) Establish compatibility of the CI operating characteristics in each mode with overall system design requirements if the CI is involved in multimode functions.

(3) Establish the existence and nature of physical and functional interfaces between the CI and other items of equipment, computer programs, and facilities.

b. Computer Program Configuration Items (CPCIs). The PDR for a CPCI or group of CPCIs is conducted after an approved Part I CI Development Specification (including detailed interface definitions) is available. The initial portion of the Part II CPCI Product Specification (see para 4.1.1b above) describing the design approach is made available by the contractor for review at the PDR. As a minimum, the following is performed:

(1) Review all detailed functional interfaces with system equipment and communication links. Review word lengths, message formats, storage available within the computer, timing, and other considerations which were established in the Part I CPCI Development Specification. At this time, the interfaces between a CPCI and hardware CIs should be defined at a level low enough to preclude subsequent definition at a lower level.

(2) Review all interfaces with existing CPCIs and/or CIs external to the system. Analyze word formats, transfer rates, etc., for incompatibilities.

(3) Review all functional interfaces between CPCIs within the system. (A more detailed review of these interfaces at a lower level is conducted at the CDR.)

(4) Review the structure of the CPCI as a whole with emphasis on the following:

(a) Allocation of computer program components to the functions delineated in the Part I Development Specification, and

computer program functional flow.

(b) Storage requirements and allocation.

(c) Computer program operating sequences.

(d) Design of the data base.

(5) Analyze critical timing requirements of the system as they apply to the CPCI to insure that proposed CPCI design will satisfy the timing requirements. Review estimated running time given by the contractor for compatibility with timing requirements.

(6) Review the CPCI interactions with the Personnel Subsystem requirements.

4.3 Design Reliability:

a. Identify the quantitative reliability requirements specified in the CI Development Specification. Compare preliminary predictions with specified requirements.

b. Review failure rate sources, derating policies, and prediction methods.

c. Identify planned actions when predictions are less than specified requirements.

d. Identify and review parts or items which have a critical life or require special consideration, and general plan for handling. Agencies so affected should initiate planning actions to cope with the items.

e. Identify applications of redundant CI elements. Evaluate the basis for their use and provisions for "on-line" switching of the redundant element.

f. Review critical signal paths to determine that a fail-safe/fail soft design has been provided.

g. Review margins of safety between functional requirements and design provisions for elements, such as: power supplies, transmitter modules, motors, and hydraulic pumps. Similarly, review structural elements; i.e., antenna pedestals, dishes, and radomes to determine that adequate margins of safety will be provided between operational stresses and design strengths.

h. Review Reliability Design Checklist to insure that design reliability concepts will be available and used by equipment designers.

i. Review preliminary reliability demonstration plan: failure counting ground rules, accept-reject criteria, number of test articles, test location and environment, planned starting date, and test duration.

j. Review elements of reliability program plan to determine that

each task has been initiated toward achieving specified requirements.

4.4 Design Maintainability:

a. Identify the quantitative maintainability requirements specified in the CI Development Specification; compare preliminary predictions with specified requirements.

b. Review preventive maintenance schedules in terms of frequencies, durations, and compatibility with system schedules.

c. Review repair rate sources and prediction methods.

d. Review planned actions when predictions indicate that specified requirements will not be attained.

e. Review planned designs for ease of maintenance to determine consistency with specified requirements.

f. Determine if parts, assemblies, and components are so placed that there is sufficient space to use test probes, soldering irons, and other tools without difficulty and that they are placed so that structural members of units do not prevent access to them or their ease of removal.

g. Review provisions for diagnosing cause(s) of failure; means for localizing source to lowest replaceable element; adequacy and locations of test points; and planned system diagnostics that provide a means for isolating faults to and within the CI.

h. Review the Design for Maintainability Checklist to insure that listed design principles will lead to a mature maintainability design. Determine that contractor design engineers are using the checklist.

i. Evaluate the preliminary maintainability demonstration plan, including number of maintenance tasks that will be accomplished; accept-reject criteria; general plans for introducing faults into the CI; and personnel involved in the demonstration.

j. Review elements of maintainability program plan to determine that each task has been initiated towards achieving specified requirements.

4.5 Personnel Subsystem. The contractor shall present evidence that substantiates the functional allocation decisions. The Review covers all operational and maintenance functions of the CI. In particular, the approach to be followed emphasizes the functional integrity of the man with the machine to accomplish a system operation. Neither the man nor the machine is reviewed individually at this time, but the function(s) to be performed are examined with respect to this or other possible man/machine combinations. Specifically, the following is accomplished:

a. Review design data, flow charts, and drawings on system operations, equipments, and facilities to insure that human performance requirements of the CI Development Specification are met.

b. Make recommendations to update the System or System Segment Specification in cases where requirements for human performance need to be more detailed.

c. Review man/machine functions to insure that man's capabilities are utilized and that his limitations are not exceeded. (AFSC DH 1-3, may be used as a guide for this analysis).

4.6 Safety:

a. Review results of CI safety analyses, operating hazard analyses, and quantitative hazard analyses (if applicable).

b. Review results of system and intra-system safety interfaces and trade-off studies affecting the CI.

c. Review safety requirements levied on subcontractors.

d. Review known special areas of safety peculiar to the nature of the system (e.g., fuel handling, fire protection, high levels of radiated energy, high voltage protection, safety interlocks, etc.)

e. Review results of preliminary safety tests (if appropriate).

f. Generally review adequacy and completeness of CI from design safety viewpoint.

4.7 Natural Environment:

a. Review contractor's planned design approach toward meeting climatic conditions (operating and non-operating ranges for temperature, humidity, etc.) that are specified in the Part I CI Development Specification.

b. Insure that the contractor clearly understands the effect of, and the interactions between, the natural aerospace environment and CI design. In cases where the effect and interactions are not known or are ambiguous, insure that studies are in progress or planned to make these determinations.

c. Current and forecast natural aerospace environment parameters may be needed for certain CIs; e.g., display of airbase conditions in a command and control system, calculation of impact point for a missile, etc. Insure compatibility between the CI design and appropriate meteorological communications by comparing characteristics of the source (teletype, facsimile, or data link) with that of the CI. Insure that arrangements or plans to obtain needed information have been made and that adequate display of natural environmental information will be provided.

4.8 Equipment and Part Standardization:

a. Equipment and Components:

(1) Review current and planned contractor actions to determine that equipment or components for which standards or specifications exist will be used whenever practical. (Standard item with FSN should have first preference).

(2) Review specific trade-offs or modifications that may be required of existing designs if existing items are, or will be, incorporated in the CI.

(3) Review basis for not using existing designs which could be used with or without modification and the potential impact on overall program in the following areas if designs were used:

Performance	Size
Cost	Reliability
Time	Maintainability
Weight	Any Other

(4) Review CI design to identify areas where a practical design change would materially increase the number of standard items that could be incorporated.

(5) Insure that Critical Item specifications will be prepared for items identified as engineering or logistics critical.

b. Parts Standardization and Interchangeability:

(1) Review procedures to determine if maximum practical use will be made of parts built to approved standards or specifications. The potential impact on the overall program is to be evaluated when a part built to approved standards and specifications cannot be used for any of the following reasons:

Performance	Reliability
Weight	Maintainability
Size	Any Other

(2) Identify potential design changes that will permit a greater use of standard or preferred parts and evaluate with trade-offs that must be made.

(3) Insure understanding of procedures for preparation and submittal of non-standard parts approval requests. Determine that a team is formed for the purpose of selecting parts which have a common use for application (interchangeability) between CIs. (Ref MIL-STD-749A).

c. Assignment of Official Nomenclature:

(1) Insure understanding of procedure for obtaining assignment of nomenclature and approval of nameplates. (Ref MIL-N-7513).

(2) Determine that a nomenclature conference has been held and agreement has been reached with the Procuring Agency on the level of nomenclature; i.e., system, set, central, group, component, subassembly, unit, etc.

4.9 Value Engineering: Review the Contractor's Value Engineering Program, which may include the following:

a. Value Engineering Training of contractor personnel.

b. Areas of potential Value Engineering that are considered profitable to challenge.

c. Schedule of planned Value Engineering tasks correlated with the master schedule.

d. Projection of Value Engineering organizations and Value Teams that are, or will be, assigned to the potential areas of study.

e. Required Value Engineering document formats and data.

4.10 Transportability:

a. Review CI to determine if design meets contracts requirements governing size and weight to permit economical handling, loading, securing, transporting, and disassembly for shipment within existing capabilities of military and commercial carriers. Identify potential outsized and overweight items. Determine that Certificate of Essentiality has been obtained from Hq AFSC (DMT) for outsized or overweight items.

b. Identify items requiring special temperature and humidity control or those possessing sensitive and shock susceptibility characteristics. Determine special transportation requirements and availability for use with these items.

c. Review Transportability Analysis to determine that transportation conditions have been evaluated and that these conditions are reflected in the design of protective, shipping, and handling devices. In addition to size and weight characteristics, determine that analysis includes provision for temperature and humidity controls, minimization of sensitivity, susceptibility to shock, and transit damage.

d. During the design process, consideration should be given to the air transportability requirements of the proposed system. During the analysis of such requirements, consideration must also be made of the limitation imposed by surface transportation capabilities during the period for proposed handling movement and support.

4.11 Test:

a. Review all changes to the System and CI Specification subsequent to the established Allocated Baseline to determine whether Section 4.0 of both the System Specification and Part I CI Development Specification adequately reflects these changes.

b. Review all available test documentation (i.e., Category I and Category II Test Plans, etc.) to insure that the test program satisfies the test requirements specified in Section 4.0 of the System and Part I CI Development Specifications, including all updating changes.

c. Review status of all negative or provisional entries such as "not applicable (N/A)" or "to be determined (TBD)" in Section 4.0 of the System and Part I CI Development specifications. Review all positive entries for technical adequacy. Insure that associated test documentation includes these changes.

d. Review interface test requirements specified in Section 4.0 of the Paet I Development Specifications (for hardware and computer program CIs) for compatibility, currency, technical adequacy, elimination of redundant test. Insure that all associated test documents reflects these interface requirements.

e. Insure that all test planning documentation has been updated to include new test support requirements and provisions for long lead time support requirements.

f. Review contractor test data from prior testing to determine if such data negates the need for additional testing.

g. Examine all available breadboards, mock-ups, or devices which will be used in implementing the test program or which affect the test program, for program impact.

4.12 Maintenance and Maintenance Data:

a. Describe system Maintenance concept (Ref AFR 66-29) for impact on system design and AGE. Review adequacy of maintenance plans. Insure coverage is provided for Organizational, Intermediate and Depot Level Maintenance (Ref AFR 66-1 for definitions) of Government Furnished Equipment (GFE), and Contractor Furnished Equipment (CFE)).

b. Determine degree of understanding of the background, purpose, requirements, and usage of Maintenance (failure) Data Collection and Historical/Status Records. (Ref Data Item Titled, "Reliability and Maintainability Data Reporting and Feedback").

c. Review requirements for Maintenance Data Collection in accordance with Chapter 9, AFM 66-1 and Data Item Titled "Reliability and Maintainability Data Reporting and Feedback" to extent necessary to insure understanding of the requirements.

d. Describe method of providing Maintenance, Failure, Reliability, Maintainability Data to Procuring Agency and AFLC.

e. Describe how requirements are submitted to the Procuring Agency for Equipment Classification (EQ/CL) Codes (formerly Work Order Number Prefix/Suffix Codes) when this requirement exists.

f. Review plans for (and status of) Work Unit Coding of the equipment. Work Unit Codes shall be available for documenting Maintenance Data commencing with Category I Testing. Codes published in Work Unit Code Manuals are obtained from AFM 300-4, Vol XI. (ref Data Item titled "Technical Orders" and military specification on Work Unit Coding indicated in the selected AFPI).

g. Advise that AFLC collected AFM 66-1 Maintenance Data are available and can be requested in accordance with AFSCR/AFLCR 174-2. These data may be obtained for reliability and maintainability studies or product improvement programs.

4.13 Spares and Government Furnished Property (GFP):

a. Review logistics and provisioning planning to insure full understanding of scope of requirements in these areas and that a reasonable time-phased plan has been developed for accomplishment. Of specific concern are the areas of: provisioning requirements, GFP usage, and spare parts, and support during installation, checkout, and test. (Ref AFR 400-30, AFSCR 400-3, and AFSCM 65-2, Part 7.)

b. Review provisioning actions required by the schedule of AFLC/AFSC Forms 24, "Statement of Provisioning - Spare/Repair Parts," and AFLC/AFSC Form 16, "Provisioning Plan - Spare/Repair Parts," and identify existing or potential provisioning problems - logistic critical and long-lead time items are identified and evaluated accordingly.

c. Review plans for maximum screening and usage of GFP, and extent plans have been implemented. (Ref AFSCR/AFLCR 65-8.)

d. Review progress toward determining and acquiring total installation, checkout, and test support requirements.

4.14 Preparation for Delivery/SDPE:

a. Analyze all available specifications (System/System Segment, CI Development and Critical Items) for guidance and direction in the development of preparation for delivery (Section 5) requirements for each product fabrication and material specification.

b. Evaluate user/operational support requirements and maintenance concepts for effect and influence on package design.

c. Establish that time phased plan for package design development is in consonance with the development of the equipment design.

d. Review planned and/or preliminary equipment designs for ease of packaging and simplicity of package design.

e. Review requirements for Special Design Protective Equipment (SDPE) necessary to effectively support the item during transportation, handling and storage processes (ref MIL-P-9024). Insure SDPE is categorized as a configuration item utilizing specifications conforming to the types and forms as prescribed in MIL-STD-490. Review the SDPE

development/product specifications for adequacy of performance/interface requirements.

f. Determine initial package design baselines, concepts, parameters, constraints, etc., to the extent possible at this phase of the end item development process.

g. Insure previously developed and approved package design data for like or similar items is being utilized.

h. Establish plans for trade studies to determine the most economical and desirable packaging design approach needed to satisfy the functional performance requirements.

i. Verify the adequacy of the prototype package design.

j. Review Section 5 of specifications to insure full understanding by contractor.

4.15 Technical Manuals: Review status of the "Technical Manual Publications Plan" to insure that all aspects of the plan have been considered to the extent that all concerned agencies are apprised of the exact technical manual coverage to be obtained under this procurement. The suitability of available commercial manuals and/or modifications thereto should also be determined.

4.16 System Allocation Document:

a. Review the Draft System Allocation Document both Part I and Part II for completeness and technical adequacy to extent completed.

b. The format should provide the following minimum information:

Part I	Part II
(1) Drawing Number	(1) Specification Number
(2) Issue	(2) Equipment Nomenclature
(3) Number of Sheets	(3) CI Quantity
(4) Location	(4) Assembly Drawing
(5) CI Number	
(6) Title	
(7) Part Number	
(8) Serial Number	

4.17 Engineering Drawings: Review drafting procedures to assure that engineering drawings are being drawn to meet the contractual requirements of MIL-D-1000 and MIL-STD-100.

4.18 Post Review Action: Within five working days after completing a PDR, contractor publishes and distributes copies of the Review minutes as specified by the CDRL. The SPO officially acknowledges completion of a PDR as indicated in Chapter 1, paragraph 1.3.2d.

CHAPTER 5

CRITICAL DESIGN REVIEW (CDR)

5.1 General: The CDR is conducted on each CI prior to fabrication/production design release to insure that the detail design solutions as reflected in the Part II Product Specification and engineering drawings, satisfy performance requirements established by the Part I Development Specification. For complex/large CIs the CDR may be conducted on an incremental basis; i.e., progressive reviews are conducted versus a single CDR. The overall technical program risks, associated with each CI, shall also be reviewed on a technical, cost, and schedule basis.

5.1.1 Equipment/Facilities Configuration Items. The detail design as disclosed by the Part II Product Specification, drawings, schematics, mockups, and actual hardware is reviewed against the Part I CI Development Specification performance requirements. For other than facilities, the result of a successful CDR is to commit the design to fabrication/production; i.e., the contractor is permitted to fabricate equipment in accordance with the detail design presented at CDR and reflected in Part II Product Specification.

5.1.2 Computer Program Configuration Items (CPCIs). The CDR for a CPCI is a formal technical review of the CPCI design. The CDR is normally accomplished for the purpose of establishing integrity of computer program design at the level of flow charts or computer program logical design prior to coding and testing. When a given CPCI is a complex aggregate of computer program components (CPCs), the CDR may be accomplished in increments during Acquisition Phase corresponding to periods at which CPCs or groups of CPCs reach the completion of logical design. For less complex CPCIs, the CDR may be accomplished at a single Review meeting.

The primary product of the CDR is formal identification of specific computer programming documentation which will be released for coding and testing. By mutual agreement between the contractor and the Procuring Agency, CDRs may be scheduled concurrently for two or more CPCIs.

5.1.3 Items to be Reviewed. The contractor, as a minimum, reviews the following:

a. Equipment CIs, General.

(1) Review adequacy of the detail design reflected in the Part II/Product CI Specification in satisfying the requirements of the Part I Development CI Specification for the item being reviewed.

(2) Detail engineering drawings for the CI including schematic diagrams.

(3) Adequacy of the detailed design in the following areas:

(a) Electrical design
(b) Mechanical design
(c) Environmental control and thermal aspects
(d) Electromagnetic compatibility
(e) Power generation and grounding
(f) Electrical and mechanical interface compatibility
(g) Mass properties
(h) Reliability/Maintainability
(i) Safety Engineering
(j) Security Engineering
(k) Survivability/Vulnerability
(l) Producibility

(4) Interface control drawings.

(5) Mock-ups, breadboards, and/or prototype hardware, when available.

(6) Design analysis and test data.

(7) System Allocation Document for CI inclusion at each scheduled location.

(8) Producibility of detail design (i.e., significant materials, tooling processes, facilities, test instrumentation, skills, etc. considerations).

(9) Potential VECPs.

b. Computer Program CIs:

(1) Draft of complete Part II Product CPCI Specification with exception of instruction listings, etc., which can only be produced after coding of the program.

(2) Supporting documentation describing results of analyses, testing, etc., as mutually agreed by the Procuring Agency and the contractor.

(3) System Allocation Document for CI inclusion at each scheduled location.

c. Aerospace Ground Equipment (AGE).

(1) Review requirements which are applicable to hardware and computer program CIs (para 5.1.3a and 5.1.3b) for AGE CIs.

(2) Verify maximum consideration of GFE AGE.

(3) Identify existing or potential AGE provisioning problems.

(4) Determine qualitative and quantitative adequacy of provisioning drawings and data.

(5) Review requirement for system/CI Printed Circuit Board (PCB) Tester.

(6) Identify the number and type of PCBs CI contributes to system.

(7) Identify the number of PCBs that tester will test.

(8) Summarize status of tester.

5.2 Detailed Evaluation of Electrical, Mechanical, and Logical Designs:

a. Equipment CIs. Detailed block diagrams, schematics, and logic diagrams are compared with interface control drawings to determine system compatibility. Analytical and available test data are reviewed to insure Part I of the Development Specification has been satisfied.

b. CPCIs. The CDR is normally accomplished immediately prior to coding the CPCI or individual computer program flow charts. This is not intended to preclude release-to-coding portions of complex CPCIs as necessary to maintain schedule. As determined by the Procuring Agency, CDRs may be scheduled in conjunction with preliminary qualification test/demonstrations for indiviuual CPCs or subassemblies of the CPCI.

Normally, CDRs are accomplished at contractor's facility where the design activity is in progress. Representatives of contractors responsible for design/development of equipment or other CPCIs that interface with the CPCIs to be reviewed may participate in the CDR. As a minimum, the following is performed during a CDR:

(1) Establish compatibility of design the Part I Development Specification.

(2) Establish system compatibility of design and review all interfaces between CPCIs and between CPCs within a CPCI by analysis of detailed flow charts and other descriptive documentation.

(3) Review interactions with data base by analysis of "Compool" tables/listings, set-used listings, etc., if available.

(4) Establish design integrity by review of available test and analytical data in the form of logic diagrams, algorithms, storage allocation charts, detailed flow charts, etc.

(5) Review interfaces between CPCI and Equipment CIs to insure that changes, etc., have not affected compatibility.

5.3 Design Reliability:

a. Review the most recent predictions of quantitative reliability and compare against requirements specified in CI Development Specification. Predictions are substantiated by review of parts application stress data.

b. Review applications of parts or items with minimum life, or those which require special consideration to insure their effect on system performance is minimized.

c. Review completed Reliability Design Review Checklist to insure principles have been satisfactorily reflected in the CI design.

d. Review applications of redundant CI elements or components to establish that expectations have materialized since the PDR.

e. Review detailed reliability demonstration plan for compatibility with specified test requirements. The number of test articles, schedules, location, test conditions, and personnel involved are reviewed to insure a mutual understanding of the plan and to provide overall planning information to activities concerned.

5.4 Design Maintainability:

a. Review the most recent predictions of quantitative maintainability and compare these against requirements specified in the CI Development Specification.

b. Review preventive maintenance frequencies and durations for compatibility with overall system requirements and planning criteria.

c. Identify unique maintenance procedures required for the CI during operational use and evaluate their total effects on system maintenance concepts.

d. Identify design-for-maintainability criteria provided by the checklist in the design detail to insure that criteria have, in fact been incorporated.

e. Determine if parts, assemblies, and components are so placed that there is sufficient space to use test probes, soldering irons, and other tools without difficulty and that they are placed so that structural members of units do not prevent access to them or their ease of removal.

f. Review detailed maintainability demonstration plan for compatibility with specified test requirements. Supplemental information is provided and reviewed to insure a mutual understanding of the plan and to provide overall planning information to activities concerned.

5.5 Personnel Subsystem:

a. Review detail design presented on drawings, schematics, mockups, or actual hardware to determine that it meets human performance requirements of the CI Development Specification and accepted human engineering practices.

b. Demonstrate by checklist or other formal means the adequacy of design for human performance. (Ref MIL-STD-1472A as criteria document and AFSC Design Handbook 1-3 and AFSCM 80-3 as guidance documents).

c. Review each facet of design for man/machine compatibility. Review time/cost/effectiveness considerations and forced trade-offs of human engineering design. (Ref MIL-H-46855).

d. Evaluate the following human engineering design factors:

(1) Operator controls
(2) Operator displays
(3) Maintenance features
(4) Anthropometry
(5) Safety features
(6) Work space layout
(7) Environmental conditions (noise, lighting, ventilation, etc.)
(8) Training equipment

5.6 Safety:

a. Review CI detail design for compliance to safety design requirements.

b. Review acceptance test requirements to insure adequate safety requirements are reflected therein.

c. Evaluate adequacy of detailed design for safety and protective equipment/devices.

d. Review CI operational/maintenance safety analyses and procedures.

5.7 Natural Environment:

a. Review detail design to determine that it meets natural environment requirements of Part I CI Development Specification.

b. Insure that studies have been accomplished concerning effects of the natural environment on, or interactions with, the CI. Studies which have been in progress should be complete at this time.

c. Determine whether arrangements have been made to obtain current and/or forecast natural environment information, when needed for certain CIs. Assure compatibility of CI and source of information by comparing electrical characteristics and formats for the source and the CI.

5.8 Equipment and Parts Standardization:

a. Equipment and Components. Determine that every reasonable action has been taken to fulfill the standardization requirements for use of standard items (standard item with FSN should be first preference) and to obtain approval for use of non-standard or non-preferred items. Accordingly, the following criteria are evaluated:

(1) Data sources that were reviewed.

(2) Factors that were considered in the decision to reject known similar, existing designs.

(3) Factors that were considered in decisions to accept any existing designs which were incorporated, and the trade-offs, if any, that had to be made.

b. Parts:

(1) Determine whether there are any outstanding non-standard or non-preferred parts approval requests and action necessary for approval or disapproval.

(2) Identify non-standard-non-preferred parts approval problems and status of actions toward resolving the problems.

(3) Review potential fabrication/production line delays due to non-availability of standard or preferred parts. In such cases, determine whether it is planned to request use of parts which may be replaced by standard items during subsequent support repair cycles. Assure that appropriate documentation makes note of these items and that standard replacement items will be provisioned for support and used for repair.

(4) Require certification that maximum practical interchangeability of parts exists between components, assemblies, and CIs. Reservations concerning interchangeability are identified.

c. Assignment of Official Nomenclature:

(1) Determine whether official nomenclature and approval of nameplates have been obtained to extent practical.

(2) Determine whether DD-61, Request for Nomenclature, has been processed to the agreed level of indenture.

(3) Insure that approved nomenclature has been reflected in the Part I/Part II/Development/Product Specification.

(4) Identify problems associated with nomenclature requests (DD-61s) together with status of actions toward resolving the problems.

5.9 Value Engineering:

a. Review status of all VECPs presented per the terms of the contract.

b. Review any new areas of potential Value Engineering considered profitable to challenge.

c. If required by contract, review the actual Value Engineering accomplishments against the planned VE program.

5.10 Transportability:

a. Review transportability evaluations accomplished for those items identified as outsized, overweight, sensitive, and/or requiring special temperature and humidity controls.

b. Review actions taken as a result of the above evaluation to insure adequate facilities and transporting equipment are available to support system requirements during Production and Deployment Phases.

c. Review design of special materials handling equipment, when required, and action taken to acquire equipment.

d. Insure DOD Certificates of Essentiality for movement of equipment have been obtained for equipment exceeding limitations of criteria established in contract requirements.

e. Insure transportability approval has been annotated on design documents and will remain valid as long as no design changes are made that modify significant transportability parameters.

f. Identify equipment to be test loaded for air transportability of materiel in Military Aircraft during the Physical Configuration Audit (PCA).

5.11 Test:

a. A review updating changes to the System and Part I Development Specification subsequent to the PDR, to determine whether Section 4.0 of the specification adequately reflects these changes.

b. Review all available test documentation for currency, technical adequacy, and compatibility with Section 4.0 of the System/Part I CI Development Specification requirements.

c. For any development model, prototype, etc., on which Category I Testing may have been performed, examine test results for design compliance with Part I CI Development Specification requirements.

d. Review test requirements in Part II CI Product Specification for completeness and technical adequacy. Section 4.0 of these specifications should include sufficient information to insure equipment can be "built to" the design specified in Section 3.0.

e. Review all test documentation required to support test requirements of Section 4.0 of Part II Product CI Specifications (test procedures in particular) for compatibility, technical adequacy, and completeness.

f. Inspect any breadboards, mock-ups, or prototype hardware available for test program implications.

5.12 Maintenance and Maintenance Data:

a. Review adequacy of maintenance plans.

b. Review status of unresolved maintenance and maintenance data problems since the PDR.

c. Review status of compliance with Data Item titled "Reliability and Maintainability Data Reporting and Feedback."

5.13 Spare Parts and Government Furnished Property (GFP):

a. Review provisioning planning with AFLC and/or AMA SM representative, and ACO representative (Industrial Specialist) to insure its compatibility (content and time phasing) with contractual requirements (data and SOW items, Forms 16, 27, and 24). The end objective is to provision by a method which will insure system supportability by AFLC at operational date of the first site. Also accomplish the following:

(1) Insure understanding of contractual requirements, including time phasing, instructions from AMA, and interim release authority and procedure.

(2) Determine that scheduled provisioning actions, such as, guidance meetings and screening, are being accomplished adequately and on time.

(3) Identify existing or potential provisioning problems. (Ref Part 7, AFSCM 65-2/AFLCM 65-3, for Procuring Agency management responsibility for the total provisioning effort).

b. Determine quantitative and qualitative adequacy of provisioning drawings and data. Verify that Logistics Critical items are listed for consideration and that adequate procedures exist for reflecting design change information in provisioning documentation and Technical Orders.

c. Insure that all possible steps have been taken to identify and use DOD available standard equipment (FSN) for incorporation into, or in support of, the CI (both operational and MGE). (Ref AFSCR/AFLCR 65-8).

d. Insure support requirements have been prepared for installation, checkout, and test for approval by Procuring Agency. Insure MIL-S-38711 screening has been accomplished and results are included into support requirements lists. (Ref AFSCR 400-3).

e. Determine that adequate storage space requirements have been programmed for on-site handling of Installation and Checkout (I&C), test support material, and a scheme has been developed for "down streaming" or stockage of insurance (high cost) or catastrophic failure support items. (See AFR 400-30 for guidance).

f. Assure that Procurement Method Coding (PMC) is considered.

5.14 Preparation for Delivery/SDPE:

a. Review proposed package design to insure that adequate protection

to the CI is provided against natural and induced environments/hazards to which the equipment will be subjected throughout its life cycle. Such analysis shall include, but not be limited to, the following:

(1) Methods of preservation.

(2) Physical/mechnaical/shock protection including cushioning medias, shock mounting and isolation features, load factors, support pads, cushioning devices, blocking and bracing, etc.

(3) Mounting facilities and securing/hold-down provisions.

(4) Interior and exterior container designs.

(5) Handling provisions and compatibility with 463L aircraft materials handling system.

(6) Container marking.

(7) Consideration of dangerous/hazardous commodities.

b. Review design of Special Design Protective Equipment (SDPE) for the CI when SDPE is required. The analysis of the proposed container or handling/shipping equivalent shall encompass as a minimum:

(1) Location and type of internal mounting or attaching provisions.

(2) Vibration - shcok isolation features, based on the predetermined fragility rating (or other constraint) of the item to be shipped.

(3) Service items (indicators, relief valves, etc.)

(4) Environmental control features.

(5) External handling, stacking and tie-down provisions with stress ratings.

(6) Dimensional and weight data (gross and net).

(7) Bill-of-materiel.

(8) Marking provisions including the center-of-gravity location.

(9) For wheeled SDPE (self-powered or tractor/trailer) the overall length, width, and height with mounted item, turning radius, mobility, number of axles, unit contact load, number of tires, etc.

(10) Position and travel of adjustable wheels, tilting, or other adjustments to facilitate loading.

c. Review the results of trade studies, engineering analyses, etc., to substantiate selected package/SDPE design approach, choice of materials, handling provisions, environmental features, etc.

d. Insure that package/SDPE design provides reasonable balance between cost and desired performance.

e. Review preproduction test results of the prototype package design to insure that the CI is afforded the proper degree of protection.

f. To the extent completed review Section 5, Preparation for Delivery, of the Product Specification for correct format, accuracy and technical adequacy.

5.15 Technical Manuals:

Review status of prepared technical orders (T.O.s) to insure that normal progress has been maintained in accordance with the specific time phasing of the T.O.s within the program. When applicable, the Procuring Agency shall further determine the extent of the contractor efforts in obtaining T.O. numbers for assignment as required.

5.16 System Allocation Document:

a. Review maintenance of the System Allocation Document since PDR.

b. Insure plans are initiated for CI re-allocations that may be necessary due to actions occurring prior to, or during, CDR.

5.17 Post Review Action:

Within five working days after completing a CDR, the contractor publishes and distributes copies of Review minutes as specified by the CDRL. The SPO officially acknowledges completion of a CDR as indicated in Chapter 1, paragraph 1.3.2d.

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CHAPTER 6

FUNCTIONAL CONFIGURATION AUDIT (FCA)

6.1 Introduction:

a. The objective of the Functional Configuration Audit (FCA) is to verify that the CIs actual performance complies with its Part I Development Specification. Test data is reviewed to verify that the item has performed as required by its functional and/or allocated configuration identification. For CIs developed at government expense, a FCA is a prerequisite to acceptance of the development effort.

b. The FCA for a given CI may be conducted on a progressive basis throughout the CI's development and culminates at the completion of the qualification testing of the item. The FCA is conducted on that configuration of the CI which is representative (prototype or preproduction) of the configuration to be released for production of the operational inventory quantities. When a prototype or preproduction article is not produced, it is conducted on the first production article. Completion of the FCA cannot be accomplished for CIs where qualification can only be determined through integrated system testing until such testing has been completed.

c. Recommendations of CI acceptance or non-acceptance to the local contract management agency are based upon and governed by procedures and requirements outlined in subsequent paragraphs.

6.2 Contract Requirements:

The schedules for and accomplishment of the FCA are recorded on the CI development record in accordance with MIL-STD-483, Appendix VII(USAF). A CI cannot be audited without the Procuring Agency approval of the functional and/or allocated baseline. In addition, the contractor must submit the draft product specification (TYPE C PART II) for the CI to be audited to the Procuring Agency for review not less than 30 days prior to FCA.

6.3 Contractor Responsibility:

a. At least 20 days prior to the FCA date (for CIs to be audited), the contractor is to provide the following information to the Procuring Agency (this information is to be provided in addition to the general requirements of Chapter 1):

(1) Contractor representation (the test manager should be in attendance).

(2) Identification of items to be audited:

(a) nomenclature,
(b) specification identification number,
(c) configuration item identifier.

(d) Current listing of all outstanding requests for deviations (reference MIL-STD-480) against the CI, either requested of, or approved by the Procuring Agency.

6.4 FCA Team Procedures and Requirements:

a. The contractor's test procedures and results shall be reviewed for compliance with specification requirements.

b. The following testing information shall be available for the FCA team.

(1) Test plans/procedures and available acceptance test plans/procedures for the CI.

(2) A complete list of successfully accomplished functional tests during which preacceptance data was recorded.

(3) A complete list of successful functional tests if detailed test data are not recorded.

(4) A complete list of functional tests required by the specification but not recorded.

(5) Preproduction and production testing results.

c. Testing must verify that the data, procedures, and results are sufficient to insure configuration item performance as set forth in the specification Section 3 and meet the quality assurance provisions contained in the specification Section 4.

d. For those performance parameters which cannot completely be verified during testing, adequate analysis or simulations must have been accomplished. The results of the analysis or simulations will be sufficient to insure configuration item performance as outlined in the specification.

e. Test reports, procedures, and data used by the FCA team will be made a matter of record.

f. A list of the contractors internal documentation (drawings) of the configuration item will be reviewed to insure that the contractor has documented the physical configuration of the configuration item for which the test data are verified.

g. Accomplishment of any quality assurance test provisions of the CI specification to be witnessed by the Procuring Agency/program manager will be established at the time the agenda for FCA is established. All tests conducted must be supported by adequate test data. The FCA team will determine any quality assurance tests to be reaccomplished.

h. CIs which fail to pass quality assurance test provisions are to be analyzed as to the cause of failure to pass. Appropriate design corrections will be made before a CI is subjected to a requalification.

i. A checklist should be developed which identifies documentation and hardware and computer programs to be available and tasks to be accomplished at the PCA for the configuration item.

j. The FCA team has authority to:

(1) Recommend retests or additional tests.

(2) Acknowledte accomplishment of partial completion of the FCA for those CIs whose qualification is contingent upon completion of integrated systems testing.

k. For Computer Program CPCIs, the following additional requirements will be necessary:

(1) The contractor shall (provide the FCA team with a briefing for each CPCI being FCA'd) delineate the Category I test results and findings for each CPCI. As a minimum, the discussion should include requirements of the development specification that he was not able to meet including a proposed solution to each item, an account of the ECPs incorporated and tested as well as proposed, a general presentation of the entire Category I effort delineating problem areas as well as accomplishments.

(2) An audit of the Category I PQT and FQT test plans/procedures should be made and compared against the official test data. The results should be checked for completeness, accuracy, etc. Deficiencies should be documented and made a part of the FCA minutes. Completion dates for all discrepancies should be clearly established and documented.

(3) An audit of the draft/final Category I test report should be performed to validate that the report is accurate and completely describes the development tests.

(4) All ECPs that have occurred during the program should be revieved to assure that they have been technically incorporated and verified during the development test program.

(5) Preliminary and Critical Design Review minutes should be examined to assure that all findings have been incorporated and completed.

(6) A preliminary examination of the draft Product Specification should be made in order to provide guidance to the contractor for his PCA submittal.

(7) The interface requirements and the testing of these requirements should be reviewed for computer program CIs.

(8) A review of the draft computer programmer's manual and positional handbook, if applicable, should be performed.

6.5 Post Audit Actions:

a. Within 5 workdays after completion of an FCA, the contractor publishes and distributes copies of FCA minutes as specified by the CDRL.

b. The Procuring Agency will notify the contractor and the local contract management agency of requirements for any post audit action within 10 workdays after receipt of FCA minutes from the contractor.

CHAPTER 7

PHYSICAL CONFIGURATION AUDITS (PCA)

7.1 Introduction:

a. The Physical Configuration Audit (PCA) is the formal examination of the as-built version of a configuration item against its technical documentation in order to establish the CI's initial product configuration identification. After successful completion of the audit, all subsequent changes are processed by ECP action. The PCA also determines that the acceptance testing requirements prescribed by the documentation is adequate for acceptance of production units of a CI by quality assurance activities. The PCA includes a detailed audit of engineering drawings, specifications, technical data and tests utilized in production of hardware CIs and a detailed unit of technical descriptions, flow charts, listings, manual/handbooks for CPCIs. The review will include an audit of the planning and manufacturing paper against the release engineering and quality control records to make sure the as-built configuration is to the released engineering. A sample Certification Attachment (see Attachment 1) is provided as guidance documentation for recording CI certification.

b. The PCA is conducted on the first artcle of CIs identified and selected jointly by the Procuring Agency and the contractor.

c. A PCA is required on the first configuration item to be delivered by a new contractor even though a PCA was previously accomplished on the first article delivered by a different contractor. The extent of the PCA to be performed on a re-buy of a configuration item already in the Air Force inventory is at the discretion of the Procuring Agency. Formal approval by the Procuring Agency of the CI/Part II Product specification, and the satisfactory completion of a PCA results in establishment of the product baseline for the configuration item.

d. Recommendations of CI acceptance or nonacceptance to the local contract management agency are based upon and governed by procedures and requirements outlined in subsequent paragraphs.

e. Since computer program manuals/handbooks are not verified/validated within the T.O. system management process, a secondary product of the computer program PCA will be to formally review all handbooks/manuals (computer programmers manual, users handbook, etc.,) associated with the computer programming system.

7.2 Contract Requirements:

a. The schedules for, and accomplishment of the PCA are recorded on the configuration item development record in accordance with MIL-STD-483, Appendix VII (USAF). A CI cannot be PCA'd without the Procuring Agency's receipt of the current draft of the product specification (Type C, Part II). In addition, a current set of listings will be provided for each CPCI being PCA'd. The contractor shall submit the product

specification for the CI to be audited to the Procuring Agency for review not less than 30 days prior to PCA.

7.3 Contractor Responsibility:

a. At least 20 days before scheduled PCA data for items to be audited, the contractor is to provide the following information to the Procuring Agency (this information shall be provided in accordance with the general instructions of Chapter 1):

(1) PCA data and location.

(2) Agenda for the PCA.

(3) Contractor representation (the test manager should be in attendance).

(4) Identification of items to be accepted by:

(a) Nomenclature;

(b) specification identification number;

(c) configuration item identifiers;

(d) serial numbers;

(e) drawing and part numbers;

(f) identification numbers;

(g) code identification numbers;

(h) CPCI component identification numbers.

(5) A list delineating all outstanding requests for deviations (MIL-STD-480) against the CI, either requested or Procuring Agency approved.

b. The PCA cannot be performed unless data pertinent to the CI being accepted is provided to the PCA team at time of the audit. The contractor has the responsibility to compile and make this information available for ready reference. Required information includes:

(1) Approved final draft of the CI product specification.

(2) A list delineating both approved and outstanding changes against the CI.

(3) Complete shortage list.

(4) Acceptance test procedures and associated test data.

(5) Engineering drawing index.

(6) Operating, maintenance, and illustrated parts breakdown manuals.

(7) List of approved material review board actions on waivers.

(8) Proposed DD Form 250, "Material Inspection and Receiving Report."

(9) Approved nomenclature and nameplates.

(10) Manuscript copy of all CPCI handbooks/manuals.

(11) Computer program version description document.

(12) Current set of listings and updated flow charts for each CPCI.

(13) FCA minutes for each CI.

c. The contractor must also compile and make available to the FCA team at time of audit all data describing the item configuration. Item configuration data include:

(1) Current approved issue of CI specification, to include approved specification change notices and approved deviations.

(2) Identification of all changes actually made during test.

(3) Identification of all required changes not completed.

(4) All drawings and documents assembled by the top drawing number as identified in the CI product specification.

d. All test equipment used during audit must:

(1) Bear a valid calibration decal at time of test.

(2) Be sealed and certified when applicable.

7.4 PCA Team Procedures and Requirements:

a. Drawing Review Instructions:

(1) A representative number of drawings shall be reviewed to determine their accuracy and insure that they adequately describe the equipment.

(2) The mollowing minimum information shall be recorded for each drawing reviewed:

(a) Drawing number;

(b) revision letter;

(c) date of drawing approval;

(d) number of sheets;

(e) discrepancies/comments.

(3) As a minimum, the following inspections shall be accomplished for each drawing reviewed:

(a) Examination of CI to ensure that current nomenclature descriptions, part numbers and serial numbers agree with the drawings;

(b) review of drawings to ascertain that all approved changes have been incorporated in the configuration item;

(c) physically check the number of pieces of material shown on the drawing with the number actually in the equipment; e.g., if the drawing says there are four transistors of a certain type within the end item, check this information;

(d) record the number and date of each attached drawing change notice and note as a deficiency (ECOs should be incorporated);

(e) note if the drawing is marked up;

(f) note if the drawing has been released into the engineering release system. If not, note as deficiency.

b. Review and verification of contract requirements regarding transportability configuration instructions, preservation, packaging and packing.

c. Review of all records of baseline configuration for the CI by direct comparison with contractor's engineering release system and change control procedures to establish that the configuration being produced does accurately reflect released engineering data. This includes interim releases of spares provisioned prior to PCA to ensure delivery of currently configured spares. Unless otherwise directed by the Procuring Agency co-chairman, drawings may be reviewed in accordance with MIL-STD-105D.

d. Audit of contractor's engineering release and change control system to ascertain that they are adequate to properly control the processing and formal release of engineering changes. The minimum needs and capabilities set forth below are required of his engineering release records system. The contractor's formats, systems, and procedures are to be used. Information in addition to the basic requirements is to be considered part of the contractor's internal system.

(1) As a minimum, the following information will be contained on one release record supplied by the contractor, subcontractor, or vendor for each drawing number, if applicable:

(a) Serial numbers, top drawing number, specification number;

(b) drawing number, title, code number, number of sheets, date of release, change letter, date of change letter release, ECO number.

(2) The contractor's release function and documentation will be capable of determining:

(a) The composition of any part at any level in terms of subordinate part numbers (disregard standard parts);

(b) the next highest assembly using the part number, except for assembly into standard parts;

(c) the composition of the configuration item or CI part number with respect to other CIs or part numbers;

(d) the configuration item and associated serial number on which subordinate parts are used. (This does not apply to contractors below prime level who are not producing configuration items);

(e) the accountability of class I and class II changes which have been partially or completely released against the configuration item;

(f) the configuration item and serial number effectivity of any change;

(g) the standard specification number or standard part numbers used within any nonstandard part number;

(h) the contractor specification document and specification control numbers associated with any subcontractor, vendor, or supplier part number.

(3) The engineering release system and associated documentation will be capable of:

(a) Identifying changes and retaining records of superseded configurations formally accepted by the procuring activity;

(b) Identifying all class I and class II engineering changes released for production incorporation. These changes should be completely released and incorporated prior to formal acceptance of the configuration item;

(c) determining the configuration released for each configuration item at the time of formal acceptance.

(4) Engineering data will be released or processed through a central authority to ensure coordinated action and preclude unilateral release of data.

(5) Engineering change control numbers will be unique.

e. The Procuring Agency will witness the PCA and reserves the prerogative to have its representatives accomplish all or any portion of required audits, inspections, or tests. Any differences between the configuration of the CI qualified and the CI being audited must be a matter of record in the minutes of the PCA.

f. Contractor support or assistance in the accomplishment of any Procuring Agency acceptance testing for CIs is established at time agenda for PCA is established. Acceptance tests must demonstrate compliance with the CI product specification. All tests must be supported by applicable data requirements. The PCA team will determine any acceptance tests to be reaccomplished, and reserves the prerogrative to have representatives of the Procuring Agency accomplish all or any portion of the required audits, inspections, or tests.

g. CIs which fail to pass acceptance test requirements are either repaired or retested in the manner directed by the Procuring Agency cochairman of the PCA team or his authorized representative.

h. When practical, the Procuring Agency participates in the inspection and test of subcontractor-equipment end items at point of manufacture. The procedures and requirements will apply for subcontractor CIs to be shipped direct to the Government prime or associate contractors. However, in the latter cases, box A of the DD Form 250 will be properly completed to indicate inspection has been completed only at origin (or source).

i. The PCA team reviews the prepared back-up data (initial documentation which accompanies the CI) for correct types and quantities to ensure adequate coverage at the time of shipment to the user.

j. CIs which have demonstrated compliance with the product specification are approved for acceptance as follows:

(1) The Procuring Agency cochairman requires the appropriate engineering activities member and technical advisers to certify by signature that the CI has been built in accordance with the drawings.

(2) A DD Form 250 is used for Inspection and Acceptance of all deliverable configuration items. The DD 250 precisely defines the CI that has been audited. If the Procuring Agency cochairman determines that a successful PCA has been accomplished for the CI, he recommends that a DD 250 be executed by the CAO in accordance with the Inspection and Acceptance terms of the contract.

(3) If the CI cannot be accepted because of shortages, deviations, and/or waivers, or unaccomplished tests, the discrepancies will be listed on the DD 250 (block 16) with a make-up date for each discrepancy. The local Contract Administration Office (CAO) executes the PQA (block 21 origin) block only. The item (CI) is subsequently accepted when all corrections are accomplished or satisfactorily resolved by the Procuring Agency.

k. Accepted CIs are delivered in accordance with contract requirements. All changes to the CI, once the PCA has been accomplished, are implemented only as directed by engineering change procedures specified in MIL-STD-480 and MIL-STD-483(USAF), Appendix XIII or IV.

1. As a minimum, the following actions shall be performed on each CPCI being PCA'd:

(1) Review Part II specification for format and completeness.

(2) Review FCA minutes for recorded discrepancies that required action.

(3) Review computer program component (CPC) descriptions and flow charts.

(4) Review CPC interface requirements.

(5) Review data base characteristics, storage allocation charts and timing and sequencing characteristics.

(6) Review flow charts for proper entries, symbols, label tags.

(7) Compare top-level CPCI flow charts with CPC flow charts.

(8) Compare detailed CPC flow charts with coded program for accuracy and completeness.

(9) Positional handbook, users manuals, and computer programming manuals should be verified for completeness and conformance with applicable data items.

(10) Actual CI (card decks, tapes, etc.,) should be examined to insure conformance with Section 5 of Specification.

(11) A current listing should be cross-checked with the listing in the Part I specification.

7.5 Post Audit Actions:

a. Procuring Agency acceptance or rejection of the CI and the CI product specification presented for PCA must be furnished the contractor in writing by the local contract management agency or other designated agency within five days after completion of PCA.

b. Within five workdays after completion of a PCA, the contractor publishes and distributes copies of PCA minutes as specified by the CDRL.

c. The Procuring Agency notifies the contractor and local contract management agency of requirements for any post-audit action within 10 workdays after receipt of PCA minutes from the contractor.

d. Product Baseline Effectivity. The CCBD (AFSC Form 232) showing approval of the product specification (Type C Part II) will be used to notify the contracting officer that the specification defining the product baseline of the configuration item has successfully satisfied the physical configuration audit and will direct contractual incorporation of the product specification for acceptance of subsequent deliveries of the CI.

7.6 PCA Certification Attachment:

Attachment 1 is provided as an example means of documenting that the PCA requirements have or have not been satisfied.

- SAMPLE CERTIFICATION ATTACHMENT -

PHYSICAL CONFIGURATION AUDIT (PCA)

FOR

CI NO.(s)_____

CONTRACT NO._____

PRIME CONTRACTOR:

_____

_____

_____

EQUIPMENT MANUFACTURERS:

_____

_____

_____

APPROVED BY _____ (DESIGNEE)
PREPARING AGENCY

DATE_____

APPROVED BY _____ (DESIGNEE)
PROCURING AGENCY

DATE_____

DEFINITION OF TERMS

COMMENT - A note explaining, illustrating, or critizing the meaning of a writing. Items of this nature should be explored by the contractor and/or the Procuring Agency, but corrective action is NOT necessary to successfully accomplish a PCA.

DISCREPANCY - A note explaining, illustrating, or critizing the difference between writings. A note showing the variance between what exists and what is acceptable. Items of this nature shall be rectified by the contractor prior to successful accomplishment of a PCA. Evidence of corrective action should be supplied to the monitoring activity at DCASR/AFPRO.

REFERENCE DOCUMENTS - See AFSCM/AFLCM 375-7 and MIL-STD-483(USAF).

SCOPE/PURPOSE

Under the provisions of MIL-STD-483(USAF), Appendix XII, a Physical Configuration Audit (PCA) was conducted on the following end items of equipment:

CI NO.	NOMENCLATURE	PART NUMBER	SERIAL NO.	FSN

The purpose of the PCA was to insure accuracy of the identifying documentation and to establish a product baseline.

The establishment of a product baseline for equipment is not to be construed as meeting Procuring Agency requirements for delivery by the contractor of an operational system meeting approved acceptance criteria.

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 1
(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Product Baseline. The following documents of the issue and date shown, comprise the Product Baseline for the listed equipments/computer programs:

SPEC NO.	ASSEMBLY TOP DRAWING NO.	ISSUE	EQPT/COMP PRGM NOMENCLATURE	CI NO.

Signature(s) of PCA Team Member(s)

** _____	_____
* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**Team Chairman
*Sub-Team Chairman

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 2
(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Specification Review and Validation. Specifications have been reviewed and validated to assure that they adequately define the CI, and the necessary testing, mobility/transportability, and packaging requirements.

Check One

The Type C/Part II Specifications are complete and adequately define the CI. They shall, therefore, constitute the Product Baseline. See attachment for comments.

The Type C/Part II Specifications are unacceptable. Attached is a list of discrepancies.

Signatures of PCA Team Member(s)

* _____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

*Sub-Team Chairman

A. Specification Review and Validation Instructions. The detailed specifications listed in paragraph B. below shall be reviewed for compliance with the applicable requirements of MIL-STD-490 and MIL-STD-483(USAF). Each specification shall serve as the basic document for configuration control of the subject items. The information contained within the specifications shall be audited at the PCA.

B. Review and Validation Results:

1. Specifications Reviewed and Validated

SPEC. NO.	PART NO.	DATE	EQPT/COMP PRGM NOMENCLATURE	CI NO.

2. Specifications Reviewed and Disapproved:

(Provide attachment for causes.)

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 3
(equipment)

Contract: AF_____ Date_____

Contractor: _____

_____

Drawing Review. Drawings have been compared with the equipment to insure that the latest drawing change letter has been incorporated into the equipment, that part numbers agree with the drawings, and that the drawings are complete and accurately describe the equipment.

Attachment___ is a list of the drawings reviewed.

Check One

The drawings are complete and accurately describe the equipment. See Attachment ____ for comments.

Attachment ____ is a list of discrepancies.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

A. Drawing Review Results. The following drawings were reviewed by the PCA drawing reviewing sub-teams.

DOCUMENT NUMBER	DOCUMENT TITLE

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 4

(equipment)

Contract: AF_____ Date_____

Contractor:_____

_____

_____

Acceptance Test Procedures and Results. The acceptance test results have been reviewed to insure that testing is adequate, properly done, and certified.

Attachment ____ is a list of the documents reviewed.

Check One

Procedures and results reviewed satisfy the requirements and are accepted. See Attachment ____ for comments.

Attachment ____ is a list of discrepancies.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 5
(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Review of Shortages and Unincorporated Design Changes. The shortages and unincorporated design changes listed on the proposed DD Form 250, "Material Inspection and Receiving Report," and other record s have been reviewed.

Check One

There are no shortages or unincorporated design changes.

Attachment ____ is a list of shortages and/or unincorporated design changes, and the recommended corrective action required.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

A. Review of Shortages and Unincorporated Design Changes. All shortages and unincorporated design changes listed on the proposed DD Form 250, "Material Inspection and Receiving Report," shall be reviewed by the Procuring Agency or their designated representatives for a determination of what changes should be accomplished in the field and what changes should be accomplished at the contractor's facility. The Procuring Agency shall also determine if the reported shortages and unincorporated changes are complete.

B. Results. List the shortages and unincorporated design changes that were reviewed in compliance with requirements.

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 6

(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Review Deviations/Waivers. A review of all deviations/waivers to military specifications and standards that have been approved. The purpose is to determine the extent to which the equipment(s) undergoing PCA vary from applicable specifications and standards and to form a basis for satisfactory compliance with these specifications and standards.

In accordance with this paragraph, all applicable deviations/ waivers have been reviewed with the following results:

Check One

The equipment(s)/computer program(s) listed on Certification Sheet No. 1 of this report complies with all applicable specifications and standards. (See Attachment ____ for comments.)

Attachment ___ is a list of discrepancies and/or comments.

Signature(s) of PCA Team Member(s)

* _____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

*Sub-Team Chairman

A. Deviation/Waiver Review Team Instruction. All approved waivers and deviations to military specifications and standards shall be reviewed and recorded. Also, record any part of the PCA which fails to meet specifications or standards but is not an approved waiver/deviation.

B. Results of Team Review. List the deviations/waivers against the equipment/computer programs being PCA'd that were reviewed.

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 7

(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Examination of the Proposed DD 250. The DD Form 250 has been examined to insure that it adequately defines the equipment/computer programs and that unaccomplished tasks are included as deficiencies.

Check One

The DD Form 250 adequately defines the equipment/computer program and all unaccomplished tasks are included as deficiencies.

Attachment ___ is a list of discrepancies and/or comments.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

A. Examination of the Proposed DD Form 250. The proposed DD Form 250 shall be examined for completeness and an accurate definition of the equipment/computer programs. Unaccomplished tasks, shortages, and certain specified discrepancies uncovered at the PCA shall be included in the DD Form 250. If the equipment/computer programs is to be shipped from the plant, the Program Office representative will recommend to the CAO that the DD Form 250 be executed in accordance with the terms of the contract.

B. Results. Include a statement that the proposed DD 250 was examined and was recommended.

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 8
(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

Review of Contractor's Engineering Release and Change Control System. The contractor's engineering release system and change control procedures have been reviewed to insure that they are adequate to properly control the processing and formal release of engineering changes.

Check One

The contractor's engineering release system and change control procedures are adequate for the processing and formal release of engineering changes. See Attachment ____ for comments.

Attachment ____ is a list of deficiencies.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 9

(equipment)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

T.O. 00-20 Series Review. Assure that the historical records program (T.O. 00-20 series), as required by the contract, has been implemented. Indicate on attached list those forms that are applicable.

In accordance with this paragraph, the contractor's historical records program has been reviewed with the following results:

Check One

The requirement has been satisfied, and the historical records program is certified as being adequate.

Attachment ___ is a list of comments and recommendations.

This task is not required by contract.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

T. O. 00-20 SERIES REVIEW

Applicable Yes	No	
☐	☐	1. T.O. 00-20-4, Configuration Management Historical Records.
☐	☐	a. AFTO Form 95, Significant Historical Data.
☐	☐	b. DD Form 829-1, Historical Record-Technical Instruction Compliance Record.
		2. T.O. 00-20-8, Ground C-E-M Maintenance Records
☐	☐	a. AFTO Form 208, Component Replacement Record.
☐	☐	b. AFTO Form 120, Electron Tube Life Record.
☐	☐	c. AFTO Form 229, Telephone Number Assignment Record.
☐	☐	d. AFTO Form 224, Cable Record.
☐	☐	e. AFTO Form 376, Circuit Layout Record/Trouble Report.
☐	☐	f. AFTO Form 233, Cable Transfer Work Sheet.
☐	☐	g. AF Form 1075, Telephone Service Order.
☐	☐	h. AFTO Form 121, Line Record.
☐	☐	i. AFTO Form 122, Key Systems Record/Work Sheets.
☐	☐	j. AFTO Form 226, Monthly Storage Battery Record.

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 10
(for equipment/computer programs)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

System Allocation Document Review. The following System Allocation book form drawings, both Part I and Part II, have been reviewed and validated to insure that they adequately identify, and are compatible with the shipping instructions.

Check One

The System Allocation Document is complete and adequately defines the equipment/computer programs scheduled for each location.

The System Allocation Document is unacceptable. Attached is a list of discrepancies.

This task is not required by contract.

Signature(s) of PCA Team Member(s)

* _____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Sub-Team Chairman

A. System Allocation Document Instructions:

1. All System Allocation, both Part I and Part II, applicable to this contract end item shall be reviewed to determine their accuracy and insure that they adequately describe the equipment.

2. The following information shall be recorded:

Part I.

a. System employment and configuration.

b. Specification reference.

c. Location.

d. Mission Equipment
Configuration Item #
Short title
Part number
Serial #

e. Installed equipment/computer program.
Configuration Item #
Short title
Part number
Serial number

f. Drawing title and number.

g. Number of sheets.

h. Issue number.

Part II.

a. Location.

b. Specification number.

c. Equipment/computer program nomenclature.

d. CI quantity.

e. Assembly. Drawing number.

3. Insure that the System Allocation Documents are compatible with the priorities and shipping instructions.

B. System Allocation Document Review Results. The following System Allocation Documents were reviewed by the PCA Reviewing Sub-Team for compliance with Appendix XI, MIL-STD-483.

DOCUMENT NUMBER	DOCUMENT TITLE

PHYSICAL CONFIGURATION AUDIT

CERTIFICATION SHEET NO. 11
(equipment)

Contract: AF_____ Date_____

Contractor: _____

_____

_____

1. Review of Logistics Plan for Pre-operational Support. The Logistics Plan for Pre-operational Support (Ref DID 1-102) has been reviewed to insure that it is adequate to support the acquisition phase and is compatible with the operational phase maintenance concept and support requirements.

Check One

The contractor's logistic plan for pre-operational support will fulfill the acquisition phase requirements and is compatible with operational phase needs.

Attachment ___ is a list of deficiencies.

2. Review of Long Lead Time Items and Provisioned Items Processed to PCA. Long Lead Time items released and items provisioned, prior to PCA have been reviewed to insure that obsolete items resulting from pre-PCA design changes are purged from the system. Where basic items may be upgraded by rework or modification these actions have been verified as accomplished or in process based upon design change notice.

Check One

Long lead time items and provisioned items processed, prior to PCA, are all of current configuration at time of PCA or are in work.

Attachment ___ is a list of deficiencies.

Signature(s) of PCA Team Member(s)

* _____ _____

_____ _____

_____ _____

_____ _____

*Sub-Team Chairman

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CHAPTER 8

FORMAL QUALIFICATION REVIEW (FQR)

8.1 General. The objective of the FQR is to verify that the actual performance of a CI as determined through test complies with its Part I Development Specification, and to identify the test report(s)/data which document results of qualification tests of the CI. Government certification of formal qualification is recorded on the Configuration Item Development Record. AFSCR/AFLCR 80-16 provides additional guidance for the FQR. The point of Government certification will be determined by the Procuring Agency and will depend upon the nature of the program, risk aspects of the particular CI, and contractor progress in successfully verifying the CI requirements. When feasible, the FQR will be combined with the FCA at the end of Category I testing, prior to PCA. If sufficient test results are not available at the FCA to insure the CI will perform in its system environment, the FQR will be conducted (post PCA) during Category II testing whenever the necessary tests have been successfully completed to enable CI certification. For non-combined FCA/FQRs, traceability, correlation, and completeness of the FQR shall be maintained with the FCA and duplication of effort avoided.

8.2 Requirements:

8.2.1 In cases where the FQR and the FCA can be accomplished in a single combined Audit/Review, contractor and Government "certification" of the CI will be accomplished after completion of the FCA and such certification will be considered as accomplishment of the FQR. The contractor shall, after notification of certification by the Procuring Agency, enter the date of CI certification of qualification and the identity of the test report(s)/documentation which sets forth the results of the associated test(s) in the CI Development Record (DID C-111). Such an entry will signify that the CI has been officially qualified for entry into the Government inventory.

8.2.2 When the Procuring Agency (normally the Deputy Director for Test and Deployment) judges that the CI is not ready for FQR at the time of FCA, the FQR will be delayed until it is determined that sufficient information on the CI's qualification is available. The FQR may be delayed up to the end of Category II testing if deemed necessary.

8.2.3 When a separate FQR is necessary, the contractor shall notify the Procuring Agency of the sufficiency of the CI test results to substantiate a FQR and coordinate the agenda with the Deputy Director for Test and Deployment. The FQR team will be assembled in the same manner as that required for the FCA team. No duplication of FCA effort shall occur at the FQR; however, the following additional efforts must be accomplished:

a. A review of the FCA minutes must be performed and the FQR shall be considered as an extension of the FCA. New/additional

qualification data must be audited and reviewed to insure qualification of the CI against its Part I Development Specification.

b. Any testing accomplished against CI qualification during Category II testing shall be considered.

c. The contractor shall, after notification of certification by the Procuring Agency, enter the date of CI certification of qualification and the identity of the test reports/documentation which sets forth the results of the associated test(s) in the CI Development Record (DID C-111).

8.2.4 All other factors such as: agenda, team organization, review procedures, data to be reviewed, etc., will be accomplished as delineated in the FCA and General Requirements and Procedures chapters of this document to the extent necessary to accomplish the FQR.

8.3 Post Review Action. Within five working days after the conduct of the FQR, the contractors shall publish and distribute the minutes in accordance with the CDRL (DID C-131). The Procuring Agency will officially acknowledge the conduct of the Review as indicated in Chapter 1, para 1.3.2.d.

CHAPTER 9

REFERENCE DOCUMENTS

SPECIFICATIONS:

MIL-N-7513	Nomenclature Assignment, Contractors Method for Obtaining
MIL-V-38352	Value Engineering Program Requirements
MIL-S-38711	Screening Data to be Furnished by Government Suppliers
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment, and Facilities
MIL-S-83490	Specifications, Types and Forms

STANDARDS:

MIL-STD-105D	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-480	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-481	Configuration Control - Engineering Changes, Deviations & Waivers (Short Form)
MIL-STD-482	Configuration Status Accounting Data Elements and Related Features
MIL-STD-483	Configuration Management Practices for USAF Systems and Equipment
MIL-STD-490	Specification Practices
MIL-STD-499	System Engineering Management
MIL-STD-749A	Preparation and Submission of Data for Approval of Non-Standard Electronic Parts
MIL-STD-882	System Safety Program for Sysjems and Associated Subsystems and Equipment
MIL-STD-1472A	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities

MANUALS:

AFM 66-1	Maintenance Management
AFM 300-4	Maintenance Data Elements & Codes, Vol XI
AFSCM 65-2	Air Force Provisions, Policies, and Procedures
AFSCM 80-3	Handbook of Instructions for Aerospace Personnel Subsystem Designers
AFSCM 127-1	System Safety Management
AFSCM 207-1	System Security Engineering
AFSCM 310-1	Management of Contractor Data and Reports
AFSCM 375-4	System Program Management Procedures
AFSCM 375-5	System Engineering Management Procedures
AFLCM/AFSCM 375-6	Optimum Repair - Level Analysis
AFSCM/AFLCM 375-7	Configuration Management for Systems and Equipment

REGULATIONS:

AFR 57-6	High Dollar Spare Parts Breakout Program
AFR 65-3	Configuration Management
AFR 66-1	Equipment Maintenance, Policy, Objective, and Responsibilities
AFR 80-28	Engineering Inspections
AFR 80-46	Management of Personnel Subsystem/ Human Factors in System, Subsystem, Equipment, and Modification Development
AFR 320-1	Air Force Value Engineering Program
AFR 320-2	Value Engineering Change Proposals Reporting Requirements
AFR 400-30	Government Support of Contractors in Weapons Systems Site Activation Activities

AFSCR/AFLCR Sup 1 to AFR 57-6	High Dollar Spare Parts Breakout Program
AFSCR/AFLCR 65-8	Utilization of Long-Supply Assets as Government-Furnished Materiel
AFSCR 320-1	AFSC Value Engineering Program
AFSCR 400-3/AFLCR 400-19	Joint Use of Spares for Support of Systems Program

AFSC DESIGN HANDBOOKS:

SERIES 1-0 GENERAL

DH 1-1 General Index and Reference

1-2 General Design Factors

1-3 Personnel Subsystems

1-4 Electromagnetic Compatibility

1-5 Environmental Engineering

1-6 System Safety

1-7 Aerospace Materials

1-8 Microelectronics

1-9 Maintainability/Reliability

1-X Checklist of General Design Criteria

SERIES 2-0 AERONAUTICAL SYSTEMS

DH 2-1 Airframe

2-2 Crew Stations & Passenger Accomodations

2-3 Propulsion and Power

2-4 Avionics Subsystems and Equipment

2-5 Armament

2-6 Ground Equipment and Facilities

2-7 System Survivability

2-X Design Checklist for Aeronautical Systems

SERIES 3-0 SPACE AND MISSILE SYSTEMS

DH 3-1 Ballistic Missiles

3-2 Space Vehicles

3-3 Ground Equipment and Facilities

3-4 System Survivability

3-X Design Checklist for Space and Missile Systems

SERIES 4-0 ELECTRONIC SYSTEMS

DH 4-1 Command/Control Systems

4-2 Electronic Systems Test and Evaluation

4-3 Electronic Systems Facilities

4-4 System Survivability

4-X Design Checklist for Electronic Systems

OTHER PUBLICATIONS:

DOD 4100.35G	Integrated Logistics Support Planning Guide
DOD Handbook 5010.8-H	Value Engineering
AFPI 71-531(31)	Technical Order Data Requirement for Ground C-E-M Equipment, Facilities, Sites, and Systems
ASPR I, Part 17	Contractor's Value Engineering Sharing Arrangements

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13. ABSTRACT

Provided are joint Procuring Agency-Contractor requirements for the actual conduct of the following technical reviews and audits:

System Requirements Review (SRR)
System Design Review (SDR)
Preliminary Design Review (PDR)
Critical Design Review (CDR)
Functional Configuration Audit (FCA)
Physical Configuration Audit (PCA)
Formal Qualification Review (FQR)

The requirements contained herein are in consonance with the "Packard Policy" (28 May 1970 Memo), MIL-STD-499 (System Engineering Management), and MIL-STD-483 (Configuration Management Practices for Systems, Equipments, Munitions, and Computer Programs). This document supersedes ESD Exhibit EST-3 (Instructions for Conducting Formal Technical Reviews, Inspections, and Demonstrations).

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MIL-STD-483						
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AFSCM/AFLCM 375-5						
Systems Engineering Management						
Configuration Management						